FINAL
MONITORNG WELL INSTALLATION WORK PLAN
PAVILLION, WYOMING

Prepared for:
U.S. Environmental Protection Agency
National Risk Management Research Laboratory
Ground Water and Ecosystem Restoration Division
Ada, Oklahoma

Prepared by:
Shaw Environmental and Infrastructure, Inc.
312 Directors Drive
Knoxville, Tennessee 37923

CONTRACT NO. EP-C-08-034
PROJECT NO. 135976

May 2010

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MWIWP Worksheet#1
Title and Approval Page

Draft
Monitoring Well Installation Work Plan
Pavillion, Wyoming

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Knoxville, Tennessee 37923

Project Officer U.S. Environmental Protection Agency	Mary-Sue McNeil	Date: 6/1/2010
Work Assignment Manager U.S. Environmental Protection Agency	Dominic Digiulio	Date: 6/1/2010
QA Manager U.S. Environmental Protection Agency	Steve Vandegrift	Date: 6/1/10
Project Manager Shaw Environmental, Inc	Sujith Kumar	Date: 06-01-10
Project Technical Manager Shaw Environmental, Inc.	Lowell Wille	Date: 5-27-10
Project QC Officer Shaw Environmental, Inc.	Tom McCrory	Date: 5-27-10

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liabilities Act
DQO	Data Quality Objective
EPA	U.S. Environmental Protection Agency
EZ	exclusion zone
FADL	field activity daily log
HASP	health and safety plan
IDW	Investigation Derived Waste
ID	inside diameter
MWIMP	Monitoring Well Installation Work Plan
POC	point of contact
PQO	Project Quality Objective
POTW	Public Owned Treatment Works
PPE	personal protective equipment
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
SI	Site Investigation
Shaw	Shaw Environmental and Infrastructure, Inc.
SOP	Standard Operating Procedure

1.0 Introduction

This Monitoring Well Installation Work Plan (MWIWP) is being executed for the U.S. Environmental Protection Agency (EPA) National Risk Management Research laboratory, Ground Water and Ecosystem Restoration Division, Contract Number EP-C-08-034, and Technical Directive 6FS400CS. EPA has tasked Shaw Environmental and Infrastructure, Inc. (Shaw) with performing field activities associated with the borehole drilling, monitoring well installation and development, well surface completion and the management of investigation derived waste (IDW). Monitoring well sampling is not included in the technical directive scope of work. The monitoring wells are being installed in the vicinity of Pavillion, Wyoming. This MWIWP and supporting appendices present the technical approach for the successful completion of the technical directive.

Pavillion, Wyoming is a town of approximately 165 residents, located on the Wind River Indian Reservation in the middle of the Wind River Basin and is approximately 25 miles northwest of Riverton. Potable water is supplied by private wells that are typically screened several hundred feet below ground surface (bgs). Recently there have been reports of methane in several of these private wells. The monitoring wells will be installed in residential and/or semi-rural areas in and around Pavillion for the EPA to investigate potential sources of the increased methane. Discussions with local well drillers in the Pavillion area indicated methane is typically first encountered in a "second" sand layer at approximately 350 to 400 feet bgs.

1.1 Objectives

The objective of this investigation is to obtain data to determine if groundwater used for potable water at residences has been impacted by methane due to natural gas development (UOS 2008, 2009a, b). This investigation was initiated in response to complaints about odors and taste associated with water in domestic wells. EPA Region VIII has collected domestic well, surface water, and soil samples to determine potential sources of contamination in the area which include but are not restricted to natural gas development. The area has undergone extensive natural gas development which includes hydraulic fracturing of production wells and construction of pits to retain drilling muds. The specific objectives of this investigation are to:

- Determine if contamination is present in groundwater used by domestic wells;
- Determine contaminant characteristics;
- Determine the potential impacts to public health and the environment from any contaminants identified in groundwater used by domestic wells.

1.2 Scope of Work

In accordance with the Technical Directive, Shaw will provide professional services and resources necessary to install deep (up to 1,000 feet) monitoring wells. Field work is schedule to start the week of June 1, 2010 and continue through July 28, 2010. The monitoring well order (priority) will be specified by EPA.

Technical Directive required tasks include the following:

- Preparation of an integrated Quality Assurance Project (QAPP), Monitoring Well Installation Work Plan Narrative (Attachment 1), Site Health and Safety Plan (HASP - Appendix A), and Waste Management Plan (Appendix B).
- Mobilization of the needed equipment, materials and work force (including subcontractors) to commence and sustain this field effort and meet the schedule requirement.
- Site preparation which includes: identifying below ground and overhead utilities; clearing, grubbing and grading the site to allow unobstructed access to the borehole location; and securing the site from inadvertent intrusion.
- Advancing boreholes to the desired depth and logging the borehole based on drill cuttings.
- Monitoring well installation, development and surface completion,
- Management of IDW, including the packaging, transportation and disposal of drilling mud and soil cuttings, and well development purge water.
- Site restoration,
- Demobilization, and
- Prepare a data package/completion report

1.3 Reporting

Because of the relatively short activity, the project schedule baseline schedule will be used to status field activity performance weekly. A daily site report, including health and safety, quality, waste management and subcontractor performance will be prepared and posted to the project SharePoint site. The original hard copies of these reports, and all supporting field records, will be maintained at the site and transferred to the project files at the conclusion of the field effort.

Shaw will prepare a Completion Report that includes a summary of the procedures used to carry out the work activities and the analytical reports for sampling and analyses performed, monitoring well as-built drawings, disposal documentation, daily reports, and any challenges encountered along with corrective measures. The report will be submitted to EPA.

2.0 References

URS Operating Services, Inc. (UOS) 2008. "Preliminary Assessment of Pavillion Area GW Plume." December 18, 2008.

URS Operating Services, Inc. (UOS) 2009a. Field Sampling Plan for Pavillion Area GW Plume, February.

URS Operating Services, Inc. (UOS) 2009b. Site Inspection - Analytical Results Report Pavillion Area Groundwater Investigation Site, August.

U.S Environmental Protection Agency (EPA), 2005, Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs; Part 1: UFP-QAPP Manual, EPA-505-B-04-900A/DTIC ADA 427785 Version 1, March

U.S Environmental Protection Agency (EPA), 2005, Generic Quality Assurance Project Plan for the Superfund Technical Assessment and Response, Region VIII, June

U.S Environmental Protection Agency (EPA), 2001, Region 9 Superfund Data Evaluation/Validation Guidance, R9QA/006.1, December

U.S Environmental Protection Agency (EPA), 2006, Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA/240/B/6-06/001 , February

U.S Environmental Protection Agency (EPA), 2004, Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coal bed Methane Reservoirs

MWIWP Worksheet #2 - Identifying Information

Site Name/Project Name:	Ground-Water Investigatio n in Pavillion, WY
Site Location	Pavillion, Wyoming
Site Number/Code:	
Operable Unit:	
Contractor Name:	Shaw Environmental and Infrastru cture, Inc.
Contractor Number	13976
Contract Title:	Technical Directive 6FS400CS
Work Assignment Number (Project #)	Field Support 23993 (Shaw Project Number 135976)

1. Identify regulatory program: Comprehensive Environmental Response Compensation and Liabilities Act.
2. Identify approval entity: U.S. Environmental Protection Agency
3. The QAPP is (select one): ☐Generic ☒Project Specific
4. List dates of scoping sessions that were held: NA
5. List dates and titles of QAPP/Sampling Plans written for previous site work, if applicable:

Title	Approval Date
NA	

6. Organizational partners (stakcholders) and connection with lead organization:
   State of Wyoming, Department of Environmental Quality
7. List data users:
   U.S. Environmental Protection Agency
8. If any required QAPP elements and required information are not applicable to the project, then indicate the omitted QAPP elements with an "NA" and provide an explanation for their exclusions below:

MWIWP Worksheet #2 - Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	*Required Information*	*QAPP Worksheet # Or Crosswalk to Related Document*
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	NA, a scoping meeting was not held 10
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12
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2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16

MWIWP Worksheet #2 - Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # Or Crosswalk to Related Document
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3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	23 24 25
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MWIWP Worksheet #2 - Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	*Required Information*	*QAPP Worksheet # Or Crosswalk to Related Document*
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	29 30
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4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	31 32 28
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report		
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		NA

MWIWP Worksheet #3 - Distribution List

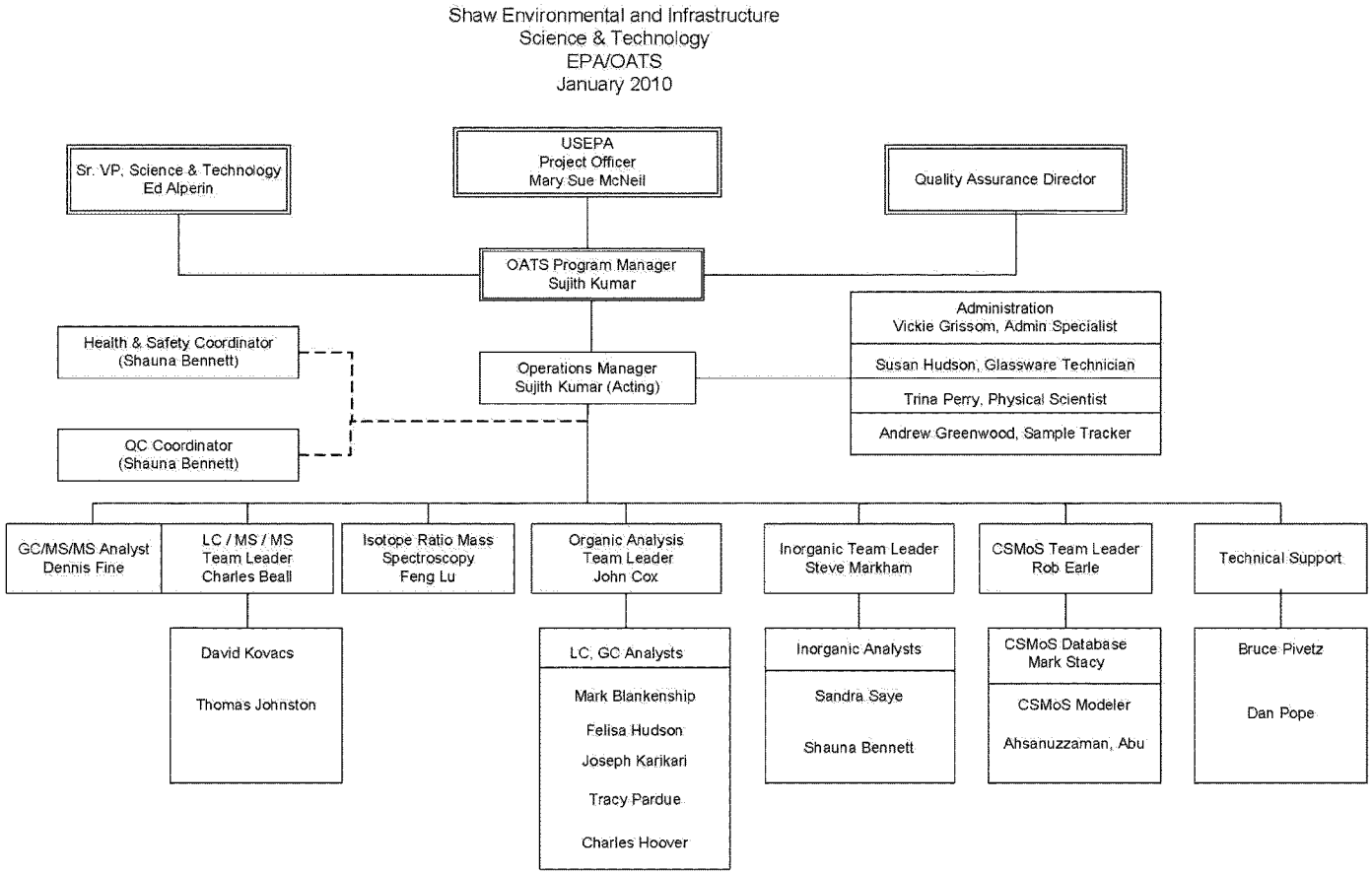
Work Plan Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number
Mary-Sue McNeil	Project Officer	ADA/EPA	(580) 436-8711	McNeil.Mary-Sue@epamail.gov	1
Steve Vandegrift	QA Manager	ADA/EPA	(580) 436-8684	Vandegrift.Steve@epamail.gov	2
Dominic Digiulio	Principal Investigator	ADA/EPA	(580) 436-8605	Digiulio.Dominic@epamail.gov	3
Sujith Kumar	Project Manager	Shaw Environmental and Infrastructure, Inc.	(580) 436-8768	Kumar.Sujith@epamail.epa.gov	4
Thomas McCrory	Project QC Officer	Shaw Environmental and Infrastructure, Inc.	(505) 412-9527	Thomas.Mccrory@shawgrp.com	5
Lowell Wille	Technical Directive manager	Shaw Environmental and Infrastructure, Inc.	(865) 694-7394	Lowell.Wille@shawgrp.com	6
Thomas McCrory	Drilling Technical Lead	Shaw Environmental and Infrastructure, Inc.	(505) 412-9527	Thomas.Mccrory@shawgrp.com	7
Kevin Jackson	Regulatory and Waste Management Specialist	Shaw Environmental and Infrastructure, Inc.	(865) 694-7479	Kevin.Jackson@shawgrp.com	8
James Wilson	On-Site Supervisor	Shaw Environmental and Infrastructure, Inc.	(770) 667-7798	James.Wilson@shawgrp.com	9

MWIWP Worksheet #4 – Project Personnel Sign-Off Sheet

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Mary-Sue McNeil	Project Officer	(580) 436- 8711		6/1/2010
Dominic Digiulio	Work Assignment Manager	(580) 436-8605		6/1/2010
Steve Vandegrift	QA Officer	580) 436-8684		6/1/10
Sujith Kumar	Project Manager	(580) 436-8768		06-01-10
Lowell Wille	Technical Directive Manager	(865) 694-7394		5-27-10
Thomas McCrory	Project QC Officer	(505) 412-9527		5-27-10
Thomas McCrory	Drilling Technical Lead	(505) 412-9527		5-27-10
James Wilson	Shaw On-Site Supervisor	(770) 667-7798		5-29-10

The Project Personnel Sign-off sheet will be used to document all key project personnel performing site work have read the applicable sections of the project-specific Monitoring Well Installation Work Plan and will perform the tasks as described.

MWIWP Worksheet #5 - Project Organizational Chart



MWIWP Worksheet #5 - Project Organizational Chart

Technical Directive Organization Chart

MWIWP Worksheet #6 -Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of Contact with EPA Technical Manager and/or Contracting Officer's Representative (COR)	Shaw Technical Directive Manager	Lowell Wille	(865) 694-7394	All information and materials relevant to the task will be forward to the appropriate EPA and Shaw Manager(s) by Lowell Wille.
Manage Field Operations	Shaw On-Site Supervisor	James Wilson	(770) 667-7798	Point of contact for all field activities.
QAPP Changes in the Field	Shaw On-Site Supervisor, Quality Assurance Specialist, Project Geologist, Drilling Subcontractor Supervisor and Sampling Technician	Thomas McCrory	(505) 412-9527	Point of contact for any changes to procedures for personnel monitoring, , general field data collection, and sample collection and shipping procedures. Changes will be verbally communicated to the Shaw Technical Directive Manager and documented.
Notification of Delays	Shaw On-Site Supervisor, Project Geologist, and Drilling Subcontractor Supervisor	James Wilson	(770) 667-7798	On-Site Supervisor will notify the Shaw Technical Directive Manager, verbally or via email or fax of any significant field work delays. Shaw Technical Directive Manager will notify the EPA and Shaw Project Managers verbally and/or via email.
Analytical data quality issues, concerns, or non-compliance	Contracted Laboratory	Thomas McCrory	(505)412-9527	Laboratory will call and or email Shaw Technical Directive Manager who may initiate corrective action.
Waste Management Disposal Option	Waste Management Specialist	Kevin Jackson	(865) 694-7479	Review IDW analytical data and select appropriate disposal option as outlined in the MWIWP

MWIWP Worksheet #7 - Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Minimum Required Experience or Qualifications
Mary-Sue McNeil	Project Officer	EPA	Management of the project including authorizing technical, shcedule and budget changes	Specified by EPA
Dpminic Digiulio	Work Assignment Manager	EPA	Technical oversight of the project	Specified by EPA
Sujith Kumar	Project Manager	Shaw Environmental and Infrastructure Inc.	Primary point of contact with EPA and stakeholders. Administers and oversees project plans and cost/schedule control. Approves staff assignments. Responsible for cost reporting and change control management.	BS in Engineering or Business, or related field and 10 years managing environmental investigation and restoration experience
Lowell Wille	Technical Directive Manager	Shaw Environmental and Infrastructure Inc.	Ensures work is performed in accordance with contract and plan requirements. Responsible for project progress reports, and technical deliverables. Manages subcontractor invoices, initiate project changes, field staff, and schedule.	BS in Engineering or related field and 10 years environmental investigation and restoration experience.
Tom McCrory	Drilling Technical Lead	Shaw Environmental and Infrastructure Inc.	Responsible for drilling and monitoring well installation activities, especially ensuring outgoing project plans and reports meet EPA technical requirements.	BS in Geology or related field and 5 years experience in drilling field supervision.
Tom McCrory	Project QA/QC Officer	Shaw Environmental and Infrastructure Inc.	Responsible for overall project quality, especially ensuring outgoing project plans and reports meet Shaw corporate quality standards established in the Shaw corporate quality program.	BS in Environmental Science or related field and 5 years experience in Quality Assurance
Kevin Jackson	Waste Management Specialist	Shaw Environmental and Infrastructure Inc.	The Waste Management Specialist ensures that the waste is properly stored after generation and characterized based on the disposal facility's waste acceptance criteria, and maintains compliance with applicable regulations and requirements.	BS in Environmental Science or related field and 5 years experience in Waste Management

MWIWP Worksheet #7 - Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Minimum Required Experience or Qualifications
Steve Hiatt	Site Quality and Health and Safety Officer	Shaw Environmental and Infrastructure Inc.	Evaluates the Site activities and Health and Safety aspects if the on-site tasks to ensure that activities are preformed in a safe manner, and are in compliance with the Work Plan and the Health and Safety Work Plan Addendum.	BS in Safety, Health, or Environmental Sciences or related field and 5 years experience in safety.
James Wilson	Geologist/On-Site Supervisor	Shaw Environmental and Infrastructure Inc.	Supervise field operations including mobilization and demobilization, borehole drilling, monitor well construction, well development, personnel monitoring, safety, and waste characterization sampling and sample shipping	BS in Geology or related field and 5 years experience in drilling field supervision

MWIWP Worksheet #8 - Special Personnel Training Requirements Table

Project Function	Specialized Training - Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
All field team members	OSHA 40 Hour HAZWOPER with current 8-Hr Refresher	Shaw or others	Annual	Shaw field personnel and drilling subcontractor	Shaw Health and Safety Training Personnel or approved vendor	Shaw Training Web Site and Health and Safety Records kept at project site.

MWIWP Worksheet #9 - Project Scoping Session Participation Sheet

Not Applicable, Specific Technical Directive Scope of Work does not require stakeholder input to the project planning process

MWIWP Worksheet #10 - Problem Definition

10.1 Site Background and Problem Definition

This investigation is being conducted to provide technical support to EPA Region VIII to complete a ground-water investigation near Pavillion, Wyoming under authority of the Comprehensive Environmental Response, Compensation, and Liability Act. EPA Region VIII is lead organization of this investigation. The investigation was initiated in response to complaints about odors and taste associated with water in domestic wells. EPA Region VIII has collected domestic well, surface water, and soil samples to determine potential sources of contamination in the area which include but are not restricted to natural gas development. The area has undergone extensive natural gas development which includes hydraulic fracturing of production wells and construction of pits to retain drilling muds. This investigation is a follow on and is intended to provide data from wells installed as part of a larger EPA CERCLA investigation (UOS, 2009b).

Deep monitoring wells are to be installed to provide controlled, high quality environmental samples to establish if the observed impacts are due to activities associated with the well field. Because of the proximity to a natural gas field and the recorded presence of methane in the shallow aquifers, there is a potential to encounter a gas pocket. Therefore, blow-out prevention is required for all deep wells.

EPA contacted a local driller, Louis Dickinson, to better understand stratigraphy at drilling locations. Mr. Dickinson, states that a highly productive white coarse-grained sandstone aquifer exists at 800 - 1000 feet in this area. The goal of drilling is to place monitoring wells in this deposit which is part of the Wind River Formation. One deep well will be drilled on the Louis Meeks property. In December 2005, Mr. Meeks contracted Mr. Dickinson to drill a domestic well to replace his existing well screened at 210'. Mr. Meeks complained of "petroleum-like" odors and taste associated with the water. While drilling the well, Mr. Dickinson recorded deposit as a function of depth outlined below.

Depth (ft)	Deposit
0 - 15	top soil
15 - 75	brown sandstone
75 - 90	gray coarse-grained sandstone
90 - 140	red and green claystone
170 - 195	gray shale
195 - 210	gray fine-grained sandstone
210 - 445	gray shale
445 - 460	gray fine-grained sandstone
460 - 520	gray shale
520 - 540	gray medium-grained sandstone
540 - 550	gray shale

Mr. Dickinson states that while developing the well to remove drilling mud, a methane gas blowout occurred on 12/19/05. The well was shut-in on 12/22/05. When the well was shut-in, a significant increase in gas production was noted in production well 14-2. Mr. Meeks states that he began smelling gas at 160 - 180' during drilling.

Another deep monitoring well will be located on the Jeff Locker property. Dr. Dickinson installed a deep domestic well in a nearby location and recorded deposit as a function of depth outlined below.

MWIWP Worksheet #10 - Problem Definition

Depth (ft)	Deposit
0 - 70	brown coarse-grained sandstone
70 - 170	gray shale
170 - 205	gray medium-grained sandstone
205 - 245	gray shale
245 - 335	gray medium-grained sandstone
335 - 420	gray shale
420 - 520	gray medium-grained sandstone
520 - 575	gray shale
575 - 595	gray fine-grained sandstone
595 - 840	gray shale
840 - 850	red and green claystone
850 - 875	white coarse-grained sandstone
875 - 940	red claystone
940 - 1000	green claystone
1000 - 1050	white coarse-grained sandstone
1050 - 1060	green claystone

10.2 Investigation Derived Waste Decisions

Investigation Derived Waste (IDW) in the forms of soil cuttings, drilling fluids (bentonite, water, and polymer mixture), well development water, and possibly aqueous decontamination fluids will need to be managed and disposed of in accordance with EPA and State of Wyoming requirements. It is anticipated that contaminants in the soils, rock and development water will be the same as those detected in the Site Investigation (UOS, 2009b). IDW characterization will include analysis for these compounds as well as standard waste characterization tests. If drilling fluids (mud) soil cuttings are non-hazardous waste and do not contain significant liquids they may be disposed of in the vicinity of the monitoring well site or in a municipal sanitary landfill. If aqueous waste is non-hazardous and meets free release criteria, it may be disposed of near the monitoring well site or the Riverton Public Owned Treatment Works (POTW). The POTW acceptance criteria include pH and compatibility (toxicity) requirements.

MWIWP Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements

11.0 Site -Specific Data Quality Objectives

The data quality objective (DQO) process is followed to evaluate data requirements and to support the decision making process associated with planning and conducting the investigation at Pavillion. The DQO process is applied to ensure that data collected to characterize environmental conditions and processes are of the appropriate type and quality to support their intended use (EPA, 2006). The following sections present the DQO rationale related to IDW sampling and analysis. The DQO planning process is applied to manage uncertainties inherent in the investigation.

11.0 Site -DQO Step 1 - Define the Problem

Compounds indicative of impact by hydrocarbon production from natural reservoirs have been detected in a clustered of residential wells. Additional investigation was recommended to obtain data from environmental wells designed and installed specifically to provide high quality samples.

11.2 DQO Step 2 - Identify the Goal of the Study

The goal of the Pavilion groundwater investigation is to determine the source of impact to potable ground water. If this study indicates impacts to groundwater have occurred, additional investigation to establish the extent of contamination may be warranted.

11.3 DQO Step 3 - Identify Information Inputs

The locations and depths, for the planned monitoring wells were selected based on the findings of the SI (UOS, 2009). This MWIWP has been prepared to ensure that data collected during this investigation are of the appropriate type and quality to support their intended use. Samples collected during implementation of this field effort will be analyzed using approved EPA SW-846 Update III methods and laboratory SOPs as presented in QAPP Worksheet #19. In general, this sampling plan has been developed to ensure that the data obtained satisfy the following requirements:

- The data are to be of sufficient quality to be legally defensible under CERCLA.
- The data will have practical quantification limits that can support their intended use.
- Data will be usable for the intended evaluations.
- Sampling locations and quantities are sufficient to support waste characterization.

11.4 DQO Step 4 - Define the Boundaries of the Study

The site location is shown on Figure 1, which shows the site boundary established to encompass suspected contaminant sources and migration pathways associated with the site.

11.5 DQO Step 5 - Develop the Analytic Approach (Decision Rules)

Analytical results from the planned sampling effort will be evaluated IDW, waste characterization. Characterization groundwater samples are being collected by EPA at a later date.

11.6 DQO Step 6 - Specify Performance or Acceptance Criteria (Decision Errors)

The primary sources of decision errors (errors that might lead to a wrong decision) include sample density and sampling and analytical methods.

MWIWP Worksheet #11 - Project Quality Objectives/Systematic Planning Process Statements

Sample Density. Sample locations, the spacing between the individual samples, and sample depths are important in obtaining data which represent the true distribution of contaminants with sufficient accuracy to achieve project objectives. Potential errors have been minimized by a) identifying historical and environmental data and b) selecting sample locations which are biased toward suspected contaminant sources.

Sampling and Analytical Methods. Sampling and analytical methods may be sources of error if proper sample collection procedures are not followed, if the analytical reporting limits exceed target goals, or if the analytical methods have an unacceptably high margin of error. Analytical methods and quality assurance procedures will conform to the Quality Management Plan (Shaw, 2009)

11.7 DQO Step 7 - Develop (Optimize) the Plan for Obtaining Data

Composite samples from roll-off bins for solid waste will be collected periodically as the bin is filled. Grab samples will be collected from holding tanks for development or purge water when the tank is full. Groundwater samples will be collected from a minimum of two wells two weeks after development.

Soil cuttings, drilling mud and aqueous samples (including development and purge water) will be sampled for pH, RCRA 8 metals (EPA Methods 6010B and 7471A), and toxic characteristic volatile and semi-volatile organic compounds (EPA Methods 8260C and 8270D). Groundwaters monitoring well locations were selected by EPA to evaluate discrete features and are located near the potentially impacted cluster of residential wells.

Solid IDW samples (drill mud and soil cuttings) will be screened on-site for methane and pH, and will be characterized using the Toxic Characteristic Leaching Procedure (TCLP) (EPA Method 1311). If necessary, absorbent material will be added to the waste so it passes a paint filter test (i.e., the waste is solid and without significant liquid fractions). Determinative analyses of the TCLP leachate will include toxic characteristic list metals (8 RCRA metals by EPA Methods 6010B and 7471A), toxic characteristic volatile and semi-volatile organic compounds by EPA Methods 8260C and 8270D- (see 40 CFR 261.24).

MWIWP Worksheet #12 - Measurement Performance Criteria Table

Matrix	Solids or Water
Analytical Group	Metals, Organic Compounds, General Chemistry
Concentration Level	Low

Sampling Procedure[1]	***Analytical*** *Method/SOP*[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
09, 10	EPA 1311, 6010B, 7470A, 8260C, 8270D	Precision	50 Relative Percent Difference (RPD)	Field Duplicates	S & A
09, 10	EPA 9095B	Precision	Agree / Disagree	Laboratory Duplicates	A
09, 10	EPA 1311, 6010B, 7470A	Accuracy/Bias	Laboratory control sample limits	Matrix Spike (metals/ligands)	A
09, 10	EPA 1311, 8260C, 8270D	Accuracy/Bias	Laboratory control limits	Surrogate Spike (organics)	A
09, 10	EPA 1311, 6010B, 7470A, 8260C, 8270D	Accuracy/Bias	Laboratory control sample limits	Laboratory Control Sample (LCS)	A
16, 17	Field pH	Precision	± 0.5 Standard Units.	Field Duplicates	S & A
16, 17	Explosive gases	Precision	± 10%	Field Duplicates	S & A

[1]Reference number from QAPP Worksheet #21 and QAPP Worksheet #23 (see Section 3.2)

MWIWP Worksheet #13 - Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Exiting Data	Site Inspection – Analytical Results Report, Pavillion Area Groundwater Invesigation Site, Pavillion, Fremont County, Wyoming	URS Operating Services, Inc., domestic and municipal water wells, March 2 to March 6, 2009	Previous data has been reviewed in the preperation of this work plan	QA/QC samples included trip blanks, duplicate samples and matrix spikes. All analytes will be analyzed by a CLP laboratory, so there will not be any restrictions on the use of the data

MWIWP Worksheet #14 - Summary of Project Tasks

This work sheet presents a summary of the activities to be performed during the Pavillion Area Groundwater Investigation monitoring well installation. This MWIWP has been prepared in accordance with the specific EPA Technical Direction requirements. Analytical requirements, field and QC samples, analytical parameters, sample containers, and holding times are specified for each parameter.

Figure 1 shows the location of the Pavillion area. Worksheet #11 lists the associated locations, sample types, analyses, and rationale. The well locations will be selected by the EPA.

14.1 Investigation Activities

Site Preparation Site Preparation will include utility clearance, clearing the drilling pad, installation of erosion/sediment control (if necessary) and construction of equipment staging areas, a decontamination pad, and exclusion or work zones

Borehole Advancement Drilling activities will include soil boring and setting a conductor casing for the deep wells, drilling bore holes for the wells and constructing monitoring wells. The wells will be drilled using mud rotary methods. Shaker tables will be used to separate the cuttings from the bentonite mud and the cuttings will be logged by the onsite geologist. Drilling wastes will be containerized on-site in roll-off bins; spent drilling mud will be placed in a watertight roll-off to prevent loss to the environment.

Well Construction Wells will be constructed using 4-inch ID threaded stainless steel 0.20 slot continuous wrap screen. The wells will have 4 inch steel risers. The wells will have 20 feet of screen. All wells will have an above grade completion with about 2-feet of stickup. The annular materials filter pack will consist of clean silica sand tremied from the base of the boring to 5 feet above the top of the screen. Above the filter pack a 5-foot bentonite seal will be placed as slurry and allowed to set. The remaining annular space will be filled to the surface with a neat cement Portland grout.

Well Development Wells will be developed until the following conditions are met.

Water samples are less than 10 NTU

A minimum of three purge volumes if the less than 10 NTU is obtained prior to attainment of three purge volumes

A minimum of five purge volumes if less than 10 NTU is not achieved after three purge volumes.

Groundwater Sampling Groundwater Sampling will be conducted by EPA personnel.

IDW Management Investigation Derived Waste will consist of drill cuttings, drilling mud and well development and purge water.

- Borehole cuttings will be separated from the drilling mud as described above in "Borehole Advancement." If the Waste Acceptance Criteria (WAC) and free release criteria are met, the borehole cuttings will be disposed of in the Sand Draw Municipal Landfill or at the drilling site, with property owner permission. The WAC are no free liquids and non-hazardous. Composite samples will be collected from the roll-off bins and analyzed as described in Section 11.7 above.

MWIWP Worksheet #14 - Summary of Project Tasks

If the drilling mud and soil cutting waste characterization results do not allow for disposal in a municipal landfill, Shaw will make arrangements for its disposal in a permitted industrial or hazardous waste landfill, as appropriate. It is not anticipated the drilling mud and cuttings will require disposal in a permitted industrial or hazardous waste landfill. However, it this occurs, Shaw will make arrangements for the materials proper disposal within the RCRA requirements.

- Used drilling mud will be stabilized using adsorbent additive until it passes the paint filter test and can be disposed of in the Municipal Landfill.

- Development purge water that is free of suspended solids may be disposed either at the monitoring well site or at the Riverton POTW. Aqueous samples will be analyzed as described in Worksheet 11.7 and the disposal option will be based on the sample results. To meet the NPDES requirements of the POTW, the pH must be within the range of 6.5 to 8.5, nonhazardous and compatible with the POTW bacteria treatment process. Samples will be provided to the POTW for WAC evaluation, but process knowledge based on the SI (UOS, 2009b) indicates the development/purge water will meet the POTW acceptance criteria.

  If the fluid waste characterization results do not allow for disposal in a POTW, Shaw will make arrangements for its disposal at a regulated facility capable of treating/ disposing of the liquid. It is not anticipated the fluids will require disposal in a regulated facility. However, if this occurs, Shaw will make arrangements for the materials proper disposal within the RCRA requirements.

Demobilization Demobilization activities will include decontaminating all equipment brought to the site, removal of all temporary facilities, and site cleanup.

14.2 Documentation

Field records of the operation of site activities, including boring and well installation activities and support activities such as equipment decontamination will be kept on standardized forms and signed daily by all personnel. At a minimum, the following data shall be included in the daily reports:

- Dates and times of beginning and completion of work
- A list of personnel, including subcontractors, at the site and their approximate work location.
- The number and location of borings and monitoring wells where work was performed and a brief description of the work at each.
- A list of major equipment on site and its location (borehole, monitoring well, or equipment decontamination location).
- Materials consumed such as screen and well casing.

MWIWP Worksheet #14 - Summary of Project Tasks

- Final boring logs and monitoring well completion depths and "as built" construction specification.
- Any problems encountered, including standby time recorded.

A Completion Report will be prepared which summarizes the field activities, including analytical reports for all sampling and analyses, as-built drawings, daily reports, and variance or nonconformance with corrective measures.

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group: Metals Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**
Aluminum	7429-90-5	WAC Specific	WAC Specific	20	40.0	20	40.0
Antimony	7440-36-0	WAC Specific	WAC Specific	1.6	2.0	1.6	2.0
Arsenic	7440-38-2	WAC Specific	WAC Specific	1.2	2.0	1.2	2.0
Barium	7440-39-3	WAC Specific	WAC Specific	2	8.0	2	8.0
Beryllium	7440-41-7	WAC Specific	WAC Specific	0.40	1.0	0.40	1.0
Cadmium	7440-43-9	WAC Specific	WAC Specific	0.40	1.0	0.40	1.0
Calcium	7440-70-2	WAC Specific	WAC Specific	400	1000.0	400	1000.0
Chromium, total	7440-47-3	WAC Specific	WAC Specific	0.80	2.0	0.80	2.0
Cobalt	7440-48-4	WAC Specific	WAC Specific	2	2.5	2	2.5
Copper	7440-50-8	WAC Specific	WAC Specific	1.6	2.0	1.6	2.0
Iron	7439-89-6	WAC Specific	WAC Specific	12	20.0	12	20.0
Lead	7439-92-1	WAC Specific	WAC Specific	0.60	1.0	0.60	1.0
Magnesium	7439-95-4	WAC Specific	WAC Specific	600	1000.0	600	1000.0
Manganese	7439-96-5	WAC Specific	WAC Specific	1.2	3.0	1.2	3.0
Mercury	7439-97-6	WAC Specific	WAC Specific	2	4.0	2	4.0
Nickel	7440-02-0	WAC Specific	WAC Specific	1.2	2.0	1.2	2.0
Potassium	7440-09-7	WAC Specific	WAC Specific	600	1000.0	600	1000.0
Selenium	7782-49-2	WAC Specific	WAC Specific	1.2	2.0	1.2	2.0
Silver	7440-22-4	WAC Specific	WAC Specific	0.40	2.0	0.40	2.0
Sodium	7440-23-5	WAC Specific	WAC Specific	600	1000.0	600	1000.0
Thallium	7440-28-0	WAC Specific	WAC Specific	0.80	1.6	0.80	1.6
Vanadium	7440-62-2	WAC Specific	WAC Specific	2	2.5	2	2.5
Zinc	7440-66-6	WAC Specific	WAC Specific	2	4.0	2	4.0

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group:VOC SW8260C Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**
1,1,1-Trichloroethane (1,1,1-TCA)	71-55-6	WAC Specific	WAC Specific	---	9000	---	9000
1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)	76-13-1	WAC Specific	WAC Specific	---	43000	---	43000
1,1,2-Trichloroethane	79-00-5	WAC Specific	WAC Specific	---	1.1	---	1.1
1,1,2,2-Tetrachloroethane	79-34-5	WAC Specific	WAC Specific	---	0.59	---	0.59
1,1,1,2-Tetrachloroethane	630-20-6	WAC Specific	WAC Specific	---	2	---	2
1,1-Dichloroethane (1,1-DCA)	75-34-3	WAC Specific	WAC Specific	---	3	---	3
1,1-Dichloroethene (1,1-DCE)	75-35-4	WAC Specific	WAC Specific	---	250	---	250
1,2,4-Trichlorobenzene	120-82-1	WAC Specific	WAC Specific	---	87	---	87
1,2-Dibromoethane (EDB)	106-93-4	WAC Specific	WAC Specific	---	0	---	0
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	WAC Specific	WAC Specific	---	0	---	0
1,2-Dichlorobenzene	95-50-1	WAC Specific	WAC Specific	---	2000	---	2000
1,2-Dichloroethane (EDC)	107-06-2	WAC Specific	WAC Specific	---	0	---	0
1,2-Dichloropropane	78-87-5	WAC Specific	WAC Specific	---	1	---	1
1,3-Dichlorobenzene	541-73-1	WAC Specific	WAC Specific	---	70	---	70
1,4-Dichlorobenzene	106-46-7	WAC Specific	WAC Specific	---	3	---	3
2-Butanone (Methyl ethyl ketone; MEK)	78-93-3	WAC Specific	WAC Specific	---	28000	---	28000
2-Hexanone (Methyl butyl ketone; MBK)	591-78-6	WAC Specific	WAC Specific	---	2440	---	2440
4-Methyl-2-pentanone (Methyl isobutyl ketone; MIBK)	108-10-1	WAC Specific	WAC Specific	---	5300	---	5300
Acetone	67-64-1	WAC Specific	WAC Specific	---	61000	---	61000
Acrylonitrile	107-13-1	WAC Specific	WAC Specific	---	0	---	0
Benzene	71-43-2	WAC Specific	WAC Specific	---	1	---	1
Bromodichloromethane (Dichlorobromomethane; DBCM)	75-27-4	WAC Specific	WAC Specific	---	0	---	0
Bromoform	75-25-2	WAC Specific	WAC Specific	---	61	---	61
Bromomethane	74-83-9	WAC Specific	WAC Specific	---	8	---	8
Carbon Disulfide	75-15-0	WAC Specific	WAC Specific	---	670	---	670
Carbon Tetrachloride	56-23-5	WAC Specific	WAC Specific	---	0	---	0
Chlorobenzene	108-90-7	WAC Specific	WAC Specific	---	310	---	310
1,1,1-Trichloroethane (1,1,1-TCA)	71-55-6	WAC Specific	WAC Specific	---	9000	---	9000
1,1,2-Trichloro-1,2,2-trifluoroethane (CFC-113; Freon 113)	76-13-1	WAC Specific	WAC Specific	---	43000	---	43000
1,1,2-Trichloroethane	79-00-5	WAC Specific	WAC Specific	---	1.1	---	1.1
1,1,2,2-Tetrachloroethane	79-34-5	WAC Specific	WAC Specific	---	0.59	---	0.59
1,1,1,2-Tetrachloroethane	630-20-6	WAC Specific	WAC Specific	---	2	---	2

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group:VOC SW8260C Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**
1,1-Dichloroethane (1,1-DCA)	75-34-3	WAC Specific	WAC Specific	---	3	---	3
1,1-Dichloroethene (1,1-DCE)	75-35-4	WAC Specific	WAC Specific	---	250	---	250
1,2,4-Trichlorobenzene	120-82-1	WAC Specific	WAC Specific	---	87	---	87
1,2-Dibromoethane (EDB)	106-93-4	WAC Specific	WAC Specific	---	0	---	0
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	WAC Specific	WAC Specific	---	0	---	0
1,2-Dichlorobenzene	95-50-1	WAC Specific	WAC Specific	---	2000	---	2000
1,2-Dichloroethane (EDC)	107-06-2	WAC Specific	WAC Specific	---	0	---	0
1,2-Dichloropropane	78-87-5	WAC Specific	WAC Specific	---	1	---	1
1,3-Dichlorobenzene	541-73-1	WAC Specific	WAC Specific	---	70	---	70
1,4-Dichlorobenzene	106-46-7	WAC Specific	WAC Specific	---	3	---	3
2-Butanone (Methyl ethyl ketone; MEK)	78-93-3	WAC Specific	WAC Specific	---	28000	---	28000
2-Hexanone (Methyl butyl ketone; MBK)	591-78-6	WAC Specific	WAC Specific	---	2440	---	2440
Chloroethane	75-00-3	WAC Specific	WAC Specific	---	15000	---	15000
Chloroform	67-66-3	WAC Specific	WAC Specific	---	0	---	0
Chloromethane	74-87-3	WAC Specific	WAC Specific	---	120	---	120
cis-1,2-Dichloroethene (cis-1,2-DCE)	156-59-2	WAC Specific	WAC Specific	---	780	---	780
cis-1,3-Dichloropropene	10061-01-5	WAC Specific	WAC Specific	---	2	---	2
Cyclohexane	110-82-7	WAC Specific	WAC Specific	---	7200	---	7200
Dibromochloromethane	124-48-1	WAC Specific	WAC Specific	---	1	---	1
Dichlorodifluoromethane (CFC-12)	75-71-8	WAC Specific	WAC Specific	---	190	---	190
Ethylbenzene	100-41-4	WAC Specific	WAC Specific	---	6	---	6
Isopropylbenzene (Cumene)	98-82-8	WAC Specific	WAC Specific	---	2200	---	2200
Methyl Acetate	79-20-9	WAC Specific	WAC Specific	---	78000	---	78000
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	WAC Specific	WAC Specific	---	39	---	39
Methylcyclohexane	108-87-2	WAC Specific	WAC Specific	---	3400	---	3400
Methylene Chloride, or Dichloromethane	75-09-2	WAC Specific	WAC Specific	---	11	---	11
Styrene	100-42-5	WAC Specific	WAC Specific	---	6500	---	6500
Tetrachloroethene (PCE; PERC)	127-18-4	WAC Specific	WAC Specific	---	1	---	1
Toluene	108-88-3	WAC Specific	WAC Specific	---	5000	---	5000
trans-1,2-Dichloroethene (trans-1,2-DCE)	156-60-5	WAC Specific	WAC Specific	---	110	---	110
trans-1,3-Dichloropropene	10061-02-6	WAC Specific	WAC Specific	---	2	---	2

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group:SVOC SW8270C Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**
1,1'-Biphenyl	92-52-4	WAC Specific	WAC Specific	---	3900	0.33	0.1
Bis(2-chloroisopropyl)ether, or 2,2'-oxybis (1-Chloropropane)	108-60-1	WAC Specific	WAC Specific	---	3.5	0.33	0.1
1,2-Dichlorobenzene	95-50-1	WAC Specific	WAC Specific	---	2000	0.33	0.1
1,3-Dichlorobenzene	541-73-1	WAC Specific	WAC Specific	---	NSV	0.33	0.1
1,4-Dichlorobenzene	106-46-7	WAC Specific	WAC Specific	---	2.6	0.33	0.1
2,4,5-Trichlorophenol	95-95-4	WAC Specific	WAC Specific	---	6100	0.33	0.1
2,4,6-Trichlorophenol (TCP)	88-06-2	WAC Specific	WAC Specific	---	61	0.33	0.1
2,4-Dichlorophenol (DCP)	120-83-2	WAC Specific	WAC Specific	---	180	0.33	0.1
2,4-Dimethylphenol	105-67-9	WAC Specific	WAC Specific	---	1200	1.3	0.1
2,4-Dinitrophenol	51-28-5	WAC Specific	WAC Specific	---	120	3.3	0.2
2,4-Dinitrotoluene (DNT)	121-14-2	WAC Specific	WAC Specific	---	0.71	0.33	0.1
2,6-Dinitrotoluene	606-20-2	WAC Specific	WAC Specific	---	0.71	0.33	0.1
2-Chloronaphthalene	91-58-7	WAC Specific	WAC Specific	---	6300	0.33	0.1
2-Chlorophenol	95-57-8	WAC Specific	WAC Specific	---	390	0.33	0.1
2-Methylnaphthalene	91-57-6	WAC Specific	WAC Specific	---	310	0.33	0.1
2-Methylphenol (o-Cresol)	95-48-7	WAC Specific	WAC Specific	---	3100	0.33	0.1
2-Nitroaniline	88-74-4	WAC Specific	WAC Specific	---	180	1.3	0.1
2-Nitrophenol (ONP)	88-75-5	WAC Specific	WAC Specific	---	NSV	0.33	0.1
3,3'-Dichlorobenzidine (DCB)	91-94-1	WAC Specific	WAC Specific	---	1.1	0.33	0.1
3-Nitroaniline	99-09-2	WAC Specific	WAC Specific	---	18	1.3	0.2
4,6-Dinitro-2-methylphenol (DNOC)	534-52-1	WAC Specific	WAC Specific	---	6.1	1.3	0.2
4-Bromophenyl phenyl ether	101-55-3	WAC Specific	WAC Specific	---	306	0.33	0.1
4-Chloro-3-methylphenol	59-50-7	WAC Specific	WAC Specific	---	NSV	0.33	0.1
4-Chloroaniline	106-47-8	WAC Specific	WAC Specific	---	2.4	0.33	0.1
4-Chlorophenyl phenyl ether	7005-72-3	WAC Specific	WAC Specific	---	NSV	0.33	0.1
4-Methylphenol (p-Cresol)	106-44-5	WAC Specific	WAC Specific	---	310	0.33	0.1
4-Nitroaniline (PNA)	100-01-6	WAC Specific	WAC Specific	---	24	1.3	0.1
4-Nitrophenol (PNP)	100-02-7	WAC Specific	WAC Specific	---	NSV	1.3	0.1
Acenaphthene	83-32-9	WAC Specific	WAC Specific	---	3400	0.33	0.1
Acenaphthylene	208-96-8	WAC Specific	WAC Specific	---	3400	0.33	0.1
Acetophenone	98-86-2	WAC Specific	WAC Specific	---	7800	0.33	0.1
Anthracene	120-12-7	WAC Specific	WAC Specific	---	17000	0.33	0.1
Atrazine	1912-24-9	WAC Specific	WAC Specific	---	2.1	0.33	0.1
Benzaldehyde	100-52-7	WAC Specific	WAC Specific	---	7800	0.33	0.1
Benzo(a)anthracene	56-55-3	WAC Specific	WAC Specific	---	0.15	0.33	0.1

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group:SVOC SW8270C Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**
Benzo(a)pyrene	50-32-8	WAC Specific	WAC Specific	---	0.015	0.33	0.1
Benzo(b)fluoranthene	205-99-2	WAC Specific	WAC Specific	---	0.15	0.33	0.1
Benzo(g,h,i)perylene	191-24-2	WAC Specific	WAC Specific	---	1700	0.33	0.1
Benzo(k)fluoranthene	207-08-9	WAC Specific	WAC Specific	---	1.5	0.33	0.1
Benzyl alcohol	100-51-6	WAC Specific	WAC Specific	---	31000	0.33	0.1
bis(2-Chloroethoxy)methane	111-91-1	WAC Specific	WAC Specific	---	180	0.33	0.1
bis(2-Chloroethyl)ether (BCEE)	111-44-4	WAC Specific	WAC Specific	---	0.19	0.33	0.1
bis(2-Ethylhexyl)phthalate (BEHP)	117-81-7	WAC Specific	WAC Specific	---	35	0.33	0.1
Butyl benzyl phthalate (BBP)	85-68-7	WAC Specific	WAC Specific	---	260	0.33	0.1
Caprolactam	105-60-2	WAC Specific	WAC Specific	---	31000	0.33	0.1
Carbazole	86-74-8	WAC Specific	WAC Specific	---	NSV	0.67	0.1
Chrysene	218-01-9	WAC Specific	WAC Specific	---	15	0.33	0.1
Di-n-butyl phthalate (DBP)	84-74-2	WAC Specific	WAC Specific	---	6100	0.33	0.1
Di-n-octyl phthalate (DNOP)	117-84-0	WAC Specific	WAC Specific	---	1220	0.33	0.1
Dibenz(a,h)anthracene	53-70-3	WAC Specific	WAC Specific	---	0.015	0.33	0.1
Dibenzofuran (DBF)	132-64-9	WAC Specific	WAC Specific	---	78	0.33	0.1
Diethyl phthalate (DEP)	84-66-2	WAC Specific	WAC Specific	---	49000	0.33	0.1
Dimethyl phthalate (DMP)	131-11-3	WAC Specific	WAC Specific	---	48900	0.33	0.1
Fluoranthene	206-44-0	WAC Specific	WAC Specific	---	2300	0.33	0.1
Fluorene	86-73-7	WAC Specific	WAC Specific	---	2300	0.33	0.1
Hexachlorobenzene (HCB)	118-74-1	WAC Specific	WAC Specific	---	0.3	0.33	0.1
Hexachlorobutadiene (HCBD)	87-68-3	WAC Specific	WAC Specific	---	61	0.33	0.1
Hexachlorocyclopentadiene (HCCPD)	77-47-4	WAC Specific	WAC Specific	---	370	0.33	0.1
Hexachloroethane (HCE)	67-72-1	WAC Specific	WAC Specific	---	61	0.33	0.1
Indeno(1,2,3-cd)pyrene	193-39-5	WAC Specific	WAC Specific	---	0.15	0.33	0.1
Isophorone	78-59-1	WAC Specific	WAC Specific	---	510	0.33	0.1
N-Nitroso-di-n-propylamine (NDPA)	621-64-7	WAC Specific	WAC Specific	---	0.069	0.33	0.1
N-nitrosodiphenylamine (NDPHA)	86-30-6	WAC Specific	WAC Specific	---	99	0.33	0.1
Naphthalene	91-20-3	WAC Specific	WAC Specific	---	3.9	0.33	0.1
Nitrobenzene	98-95-3	WAC Specific	WAC Specific	---	4.4	0.33	0.1
Pentachlorophenol	87-86-5	WAC Specific	WAC Specific	---	3	1.3	0.1
Phenanthrene	85-01-8	WAC Specific	WAC Specific	---	1700	0.33	0.1
Phenol	108-95-2	WAC Specific	WAC Specific	---	18000	0.33	0.1
Pyrene	129-00-0	WAC Specific	WAC Specific	---	1700	0.33	0.1
Pyridine	110-86-1	WAC Specific	WAC Specific	---	78	0.33	0.1
1,2,4-Trichlorobenzene	120-82-1	WAC Specific	WAC Specific	---	87	0.33	0.1

MWIWP Worksheet #15 - Reference Limits and Evaluation Table

Matrix: Drill Cuttings (solids) Analytical Group:SVOC SW8270C Concentration Level: Low	CAS Number	Project Action Limit (mg/L)	Project Quantitation Limit (mg/L)	Analytical Method		*Achievable Laboratory Limits*	
Analyte				**MDLs**	**Method QLs**	**MDLs**	**QLs**

> - Greater than.

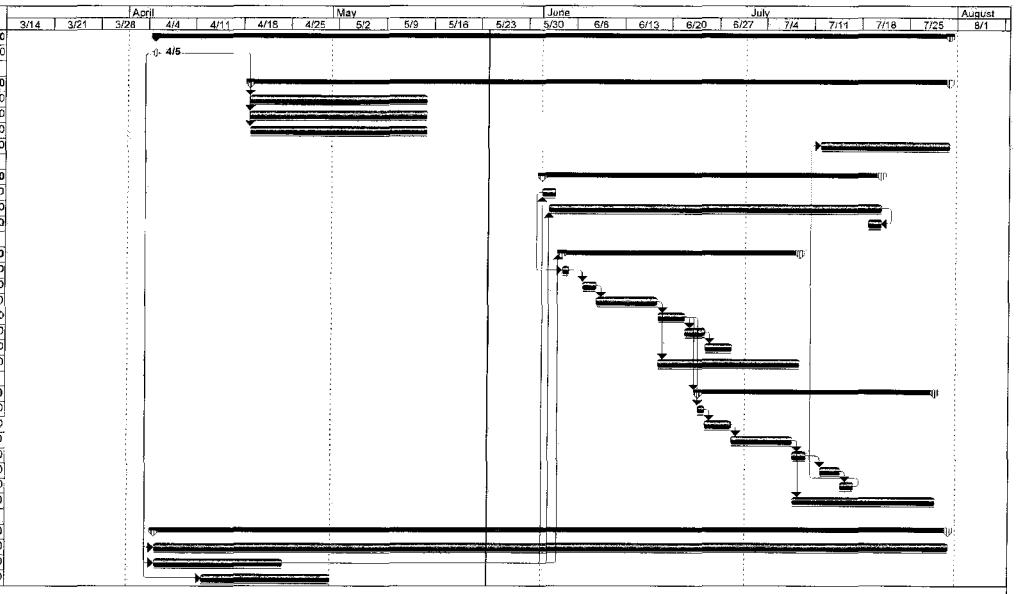
EPA - U.S. Environmental Protection Agency.

NA - Not applicable.

mg/kg - Milligrams per kilogram.

MWIWP Worksheet #16 - Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Project Summary**	**85 days**	**Mon 4/5/10**	**Fri 7/30/10**
2	Kick Off	0 days	Mon 4/5/10	Mon 4/5/10
3				
4	**Project Documents**	**75 days**	**Mon 4/19/10**	**Fri 7/30/10**
5	Work Plan	4 wks	Mon 4/19/10	Fri 5/14/10
6	Quality Assurance Project Plan	4 wks	Mon 4/19/10	Fri 5/14/10
7	Health and Safety Plan	4 wks	Mon 4/19/10	Fri 5/14/10
8	Final Data Report	3 wks	Mon 7/12/10	Fri 7/30/10
9				
10	**Site Operations**	**36 days**	**Tue 6/1/10**	**Tue 7/20/10**
11	Crew Mobilization - Site set up	2 days	Tue 6/1/10	Wed 6/2/10
12	Site Operations Support	7 wks	Tue 6/1/10	Tue 7/20/10
13	Crew Demobilization - Site tear down	2 days	Mon 7/19/10	Tue 7/20/10
14				
15	**Deep Well 1**	**25 days**	**Fri 6/4/10**	**Thu 7/8/10**
16	Mobilization	1 day	Fri 6/4/10	Fri 6/4/10
17	Rig Up	2 days	Mon 6/7/10	Tue 6/8/10
18	Drilling	7 days	Wed 6/9/10	Thu 6/17/10
19	Well Completion	2 days	Fri 6/18/10	Mon 6/21/10
20	Well Development	3 days	Tue 6/22/10	Thu 6/24/10
21	Rig Down and Demobilize	2 days	Fri 6/25/10	Mon 6/28/10
22	Waste Management	15 days	Fri 6/18/10	Thu 7/8/10
23				
24	**Deep Well 2**	**25 days**	**Thu 6/24/10**	**Wed 7/28/10**
25	Mobilization	1 day	Thu 6/24/10	Thu 6/24/10
26	Rig Up	2 days	Fri 6/25/10	Mon 6/28/10
27	Drilling	7 days	Tue 6/29/10	Wed 7/7/10
28	Well Completion	2 days	Thu 7/8/10	Fri 7/9/10
29	Well Development	3 days	Mon 7/12/10	Wed 7/14/10
30	Rig Down and Demobilize	2 days	Thu 7/15/10	Fri 7/16/10
31	Waste Management	15 days	Thu 7/8/10	Wed 7/28/10
32				
33	**Project Management**	**85 days**	**Mon 4/5/10**	**Fri 7/30/10**
34	Project Controls	17 wks	Mon 4/5/10	Fri 7/30/10
35	Drilling Bid Packages	3 wks	Mon 4/5/10	Fri 4/23/10
36	Downhole Logging Package	3 wks	Mon 4/12/10	Fri 4/30/10



Project: EPA Rev 3 2 deep wells.mpp
Date: Mon 5/24/10

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 1

MWIWP Worksheet #17 - Sample Design and Rationale

NA, Information is provided in Worksheet 11 and 12

MWIWP Worksheet #18 - Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (ft bgs)	*Analytical Group*	Concentration Level	Number of Samples (identify field duplicates	Sampling SOP Reference[1]	Rationale for Sampling Location
TBD	Drilling mud and soil cuttings	NA	Metals, Organics, Free Liquids	Low	1-5, 1 Field Dup	09, 10	Waste container characterization
TBD	Well development water	NA	Metals, Organics	Low	1-5	09, 10	Waste container characterization

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21).

MWIWP Worksheet #19 - Analytical Methods SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Drilling mud and soil cuttings	GenChem	NA	01	100 gram minimum	250 ml wide mouth glass	< 6 degrees C	Analyze as soon as practical
Drilling mud and soil cuttings	TCLP	NA	02, 03, 04, 05, 06, 07	230 gram minimum	(1) 1000 ml wide mouth glass jar (2) 250 ml wide mouth glass jar	< 6 degrees C	14 days (VOC) 14 days (SVOC) 28 days (Hg) 180 days (metals)

MWIWP Worksheet #20 - Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference	No. of Sampling Locations	No. of Field Duplicate Pairs	VOC No. of Trip Blanks	Inorganic No. of MS	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Drilling mud and soil cuttings	GenChem	Low	01	3-20 estimated	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
Drilling mud and soil cuttings	TCLP	Low	02, 03, 04, 05, 06, 07, 17, 18, 19, 20, 21	3-20 estimated	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD
Aqueous (development or purge water)	VOC SVOC Metals	Low	6,7,16, 17, 18, 19, 20, 21	1-10 estimated	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	TBD

MWIWP Worksheet #21 - Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for *Project Work?* (Check if yes)	*Comments*
01	Standards for Conduction Mud Rotary Drilling, EI-GS018, Rev. 1, 3/1/2007	Shaw Environmental	Drill Rig and Assoc. Equip.	☐	
02	Standards for Generation of Boring Logs, EI-GS027, Rev. 1, 1/30/2007	Shaw Environmental	Hand tools, color chart, etc.	☐	
03	Standards for Borehole Geophysics, EI-GS042, Rev. 1, 2/8/2007	Shaw Environmental	Logging tool, recorder, etc.	☐	
04	Standards for Design and Installation of Groundwater Monitoring Wells, EI-GS031, Rev. 1, 1/30/2007	Shaw Environmental	Drill rig, casing, screen, etc.	☐	
05	Standards for Conducting Well Development, EI-GS037, Rev. 1, 2/8/2007	Shaw Environmental	Pump, controller, bailer, etc.	☐	
06	Field Logbook, EI-FS001, Rev. 1, 9/8/2006	Shaw Environmental	Logbook, pens	☐	
07	Field Log sheet, EI-FS002, Rev. 1, 9/8/2006	Shaw Environmental	Log sheet, pens	☐	
08	Decontamination of Contact Sampling Equipment, EI-FS014, Rev. 1, 9/8/2006	Shaw Environmental	Sampling equipment	☐	
09	Sampling of In-Process Piles, EI-FS106, Rev. 1, 9/11/2006	Shaw Environmental	Sampling equipment	☐	
10	Roll-off Sampling, EI-FS107, Rev. 1, 9/11/2006	Shaw Environmental	Sampling equipment	☐	
11	Sample Mixing/Homogenization, EI-FS010, Rev. 1, 9/8/2006	Shaw Environmental	Sampling equipment	☐	
12	Compositing, EI-FS011, Rev. 1, 9/8/2006	Shaw Environmental	Sampling equipment	☐	
13	Trowel/Spoon Surface Soil Sampling, EI-FS101, Rev. 1, 9/11/2006	Shaw Environmental	Sampling equipment	☐	
14	Compositing EI-FS011, Rev. 1, 9/8/2006	Shaw Environmental	Sampling equipment	☐	
15	Measurement of Water Level and LNAPL in Monitoring Wells, EI-FS108, Rev. 1, 9/11/2006	Shaw Environmental	Water level probe	☐	
16	Sampling of Tanks and Storage Vessels, EI-FS115, Rev. 1, 9/21/2006	Shaw Environmental	Sampling equipment	☐	

MWIWP Worksheet #21 - Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for *Project Work?* (Check if yes)	*Comments*
17	Sampling of Drums and Other Containers, EI-FS116, Rev. 1, 9/21/2006	Shaw Environmental	Sampling equipment	☐	
18	Chain of Custody Documentation, Paper, EI-FS003, Rev. 1, 9/8/2006	Shaw Environmental	Forms, pens, etc.	☐	
19	Sample Labeling, EI-FS006, Rev. 1, 9/8/2006	Shaw Environmental	Labels, pens, etc.	☐	
20	Shipping and Packaging of Non-Hazardous Samples, EI-FS012, Rev. 1, 9/8/2006	Shaw Environmental	Shipping cooler, ice, tape, etc.	☐	
21	Custody Seals, EI-FS005, Rev. 1, 9/8/2006	Shaw Environmental	Shipping cooler, seals, etc.	☐	
22	Water Quality Meter Use, EI-FS204, Rev. 1, 9/22/2006	Shaw Environmental	Sampling Equipment	☐	
23	Surveillances, EI-Q006, Rev 1, 2/15,2997	Shaw Environmental	Forms, pens, etc.	☐	
24	Standards for Conducting Subsurface Soil Sampling While Drilling, EI-GS001, Rev 1, 2/26/2007	Shaw Environmental	Hand tools, color chart, etc.	☐	
25	Standards for Soil Logging, EI-GS025, Rev 1, 1/30/2007	Shaw Environmental	Hand tools, color chart, etc.	☐	
26	Standards for Design Conducting Borehole and Well Abandonment, EI-GS040, Rev 1, 2/8/2007	Shaw Environmental	Drill Rig and Assoc. Equip.	☐	
27	Field Activities Documentation, EI-G005, Rev 0, 10/1/2007	Shaw Environmental	Hand tools, color chart, etc.	☐	

MWIWP Worksheet #22 - Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Flame Ionization Detector (FID), Photovac MicroFID or equivalent	Methane calibration gas standard	Battery charging and high purity hydrogen flame gas	Per Manufacturer's operating manual	Per Manufacturer's operating manual	Daily	± 15% of known standard	Per Manufacturer's operating manual, re-calibrate	On-Site Supervisor	Manufacturer's operating manual
4-Gas LEL Detector / Meter, Orion MSA or equivalent	Calibration gas standard	Battery charging, filter changing	Per Manufacturer's operating manual	Per Manufacturer's operating manual	Daily	± 15% of known standard	Per Manufacturer's operating manul, re-calibrate	On-Site Supervisor	Manufacturer's operating manual
Water quality pH, conductivity, temperature meter, YSI 63 or equivalent	2 - pH standards, conductivity standard	Clean, rinse probes, keep moist	Battery check	Per Manufacturer's operating manual	Daily	± 0.5 pH S.U.	Per Manufacturer's operating manual, re-calibrate	On-Site Supervisor	Manufacturer's operating manual
Turbidity Meter	Turbidity standard	Battery charging; clean sample vials	Per Manufacturer's operating manual	Per Manufacturer's operating manual	Daily	± 0.1 NTU	Per Manufacturer's operating manual, re-calibrate	On-Site Supervisor	Manufacturer's operating manual
Drilling Mud Balance	NA	Cleaning of unit	Per Manufacturer`s operating manual	Per Manufacturer`s operating manual	Daily	NA	Per Manufacturer's operating manual, re-calibrate	On-Site Supervisor	Manufacturer's operating manual

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

MWIWP Worksheet #23 - Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
01	Paint Liquids Filter Test SW846 Method 9095, SOP K9095, Rev. 9, 11/15/2009	Definitive	GenChem	NA	Test America	☐
02	Standard Operating Procedures for the Toxic Characteristic Leaching Procedure SW846 Methods 1311/1312, SOP TCLP01, Rev. 8, 05/15/2009.	Definitive	GenChem	NA	Test America	☐

MWIWP Worksheet #23 - Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
03	Standard Operating Procedure Acid Digesting of Waters for Total Recoverable Inductively Coupled Plasma Spectroscopy (3010A) SOP ME411, Rev. 2, 06/15/2005	Definitive	Metals	NA	Test America	☐

MWIWP Worksheet #23 - Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
04	Standard Operating Procedure for - Inductively Coupled Plasma Atomic Emission Spectroscopy SW-846 Method 6010B/200.7 SOP ME600F, Rev. 9, 05/15/2009	Definitive	Metals	- ICP-AES	Test America	☐
05	Standard Operating Procedure Mercury (7470A, 245.1) SOP ME404, Rev. 12, 07/15/2009	Definitive	Metals	- Automated Mercury Analyzer	Test America	☐
06	Standard Operating Procedures for Analysis of Volatile Organic Analytes by Methods 8260A and 8260B, SOP MSV01, Rev. 14, 09/15/2009	Definitive	VOA	HP GC/MS Systems and Purge and Trap Units -	Test America	☐
07	Standard Operating Procedure Separatory Funnel Liquid-Liquid Extractions for Semivolatiles (BNA) Method 3510C, SOP EXB08, Rev. 12, 02/15/2010	Definitive	SVOC	NA	Test America	☐
08	Standard Operating Procedure Organic Analytes Method 8270, SOP MSS01, Rev. 17, 01/15/2010	Definitive	SVOC	GC/MS System, -	Test America	☐
09	Standard Operating Procedure Water Quality Meter Use, EI-FS204, Rev. 1, 09/22/2006	Screening	GenChem	TBD	Shaw Environmental	☐

MWIWP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
ICP-AES and CVAA	Initial calibration all analytes ICP-AES one high standard and calibration blank CVAA minimum 5 standards and calibration blank	Daily prior to sample analysis	ICP-AES None unless more than one standard is used, in which case r > 0.995 CVAA r>0.995	Correct problem and repeat initial calibration	Laboratory manager / analyst	Laboratory SOP
	Second source calibration verification (ICV)	Once after each initial calibration, prior to sample analysis	± 10% of expected value	Correct problem and verify second source standard. Rerun ICV. If that fails correct problem and repeat initial calibration.	Laboratory manager / analyst	Laboratory SOP

MWIWP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Continuing calibration verification (CCV)	After every 10 samples and at the end of the analysis sequence	ICP within ± 10% of expected value CVAA within ± 20% expected value	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration. Reanalyze all samples since last successful calibration verification.	Laboratory Manager/Analyst	Laboratory SOP
	Low-level calibration check standard (ICP)	Daily after one-point initial calibration	± 20% of expected value	Correct problem then reanalyze	Laboratory Manager/Analyst	Laboratory SOP
GC/MS	Tuning	Prior to calibration and every 12 hours during sample analysis	Method specific ion abundance criteria	Retune instrument and verify. Rerun affected samples	Laboratory Manager/Analyst	Laboratory SOP

MWIWP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Minimum five-point calibration for all analytes (ICAL)	Initial calibration prior to sample analyses	1. Average response factor (RF) for SPCCs: VOC ≥ 0.30 for Chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050 2. RSD for RFs for CCCs, VOC and SVOC ≤ 30% and one option below: RSD for each analyte ≤ 15% linear least squares regression r ≥ 0.995 non-linear regression - coefficient of determination (COD) r-squared ≥ 0.99	Correct problem then repeat initial calibration.	Laboratory Manager/Analyst	Laboratory SOP

MWIWP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ± 25% of expected	Correct problem and verify second source standard. Rerun second source verification. If that fails correct problem and repeat initial calibration.	Laboratory Manager/Analyst	Laboratory SOP
	Retention time window position establishment for each analyte and surrogate	Once per ICAL	Position shall be set using the midpoint standard of the initial calibration curve.	NA	Laboratory Manager/Analyst	Laboratory SOP
	Evaluation of relative retention times (RRT)	With each sample	RRT of each target analyte in each calibrations standard within ± 0.06 RRT units.	Correct problem then rerun ICAL	Laboratory Manager/Analyst	Laboratory SOP

MWIWP Worksheet #24 - Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
	Calibration verification (CV)	Daily before sample analysis and every 12 hours of analysis time	1. Average RF for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. %Difference/Drift for CCCs: VOCs and SVOCs ≤ 20% D	Correct problem, then rerun CV. If that fails, repeat initial calibration.	Laboratory Manager/Analyst	Laboratory SOP
	Internal standards verification	In all field samples and standards	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL. EICP area within -50% to + 100% of ICAL midpoint standard.	Inspect mass spectrometer and GD for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Laboratory Manager/Analyst	Laboratory SOP

MWIWP Worksheet #25 - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
ICP-AES	Replace disposables, pump lines, etc	Sensitivity check	Instrument performance and sensitivity	Daily or as needed	Worksheet #23	Worksheet #23	Laboratory Manager/Analyst	Laboratory SOP
CVAA	Replace disposables, flush lines	Sensitivity check	Instrument performance and sensitivity	Daily or as needed	Worksheet #23	Worksheet #23	Laboratory Manager/Analyst	Laboratory SOP
GC	Replace columns as needed, clean injector	Sensitivity check	Instrument performance and sensitivity	Daily or as needed	Worksheet #23	Worksheet #23	Laboratory Manager/Analyst	Laboratory SOP

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23).

MWIWP Worksheet #26 - Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): On-Site Supervisor, sampling technicians / Shaw Environmental
Sample Packaging (Personnel/Organization): On-Site Supervisor, sampling technicians / Shaw Environmental
Coordination of Shipment (Personnel/Organization): On-Site Supervisor, sampling technicians / Shaw Environmental
Type of Shipment/Carrier: UPS or FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Receiving / Test America
Sample Custody and Storage (Personnel/Organization): Sample Receiving / Test America
Sample Preparation (Personnel/Organization): Test America
Sample Determinative Analysis (Personnel/Organization): Test America
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Ship to lab same day as collection if possible, if not samples stored on ice and shipped as soon as practical after collection
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Analytical Laboratory - 40 days after extraction
Biological Sample Storage (No. of days from sample collection): Not applicable
SAMPLE DISPOSAL
Personnel/Organization: Test America
Number of Days from Analysis: Hold samples for 6 months

MWIWP Worksheet #27 - Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Worksheet #21, reference procedures 18, 19, 20, 21
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Laboratory QAPP
Sample Identification Procedures: Worksheet #21, reference procedures 19
Chain-of-custody Procedures: Worksheet #21, reference procedures 18, 21

MWIWP Worksheet #28 - Laboratory QC Sample Table

Matrix	Drill Cuttings / TCLP Leachate
Analytical Group	Metals
Sampling SOP	09, 10
Analytical Method/ SOP Reference	02, 03, 04, 05

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Calibration Blank	After IC, before Continuing Calibration Verification (CCV), after every 10 samples, and at end of analytical sequence	No target analytes greater than 2 x Method Detection Limit (MDL)	Re-prepare and re-analyze the blank and the affected samples in accordance with Dod QSM requirements	Laboratory Manager/Analyst	Representativeness	No target analytes greater than 2xMDL
Method Blank	One per preparation batch	No target analytes greater than 1/2 reporting limit (RL), greater than RL for common laboratory contaminants	Correct problem, then re-prepare and re-analyze the method blank and all samples processed with the contaminated blank.	Laboratory Manager/Analyst	Representativeness	No target analytes greater than 1/2 RL, greater than RL for common laboratory contaminants
Interference check solution (ICS)	At the beginning of an analytical run	Within ± 20% of expected value (A), (A,B) solutions	Identify and correct problem, then re-analyze ICS and all affected samples.	Laboratory Manager/Analyst	Accuracy/Bias	Within ± 20% of expected value (A), (A,B) solutions
Matrix Spike (metals)	One MS/MSD pair per preparation batch per matrix	Laboratory standard performance criteria (SPC) limits for percent recoveries and relative percent difference (RPD) precision	Identify problem if related to sample matrix qualifier affected sample. Else re-prepare and pre-analyze MS/MSD and associated samples in the preparation batch.	Laboratory Manager/Analyst	Precision and accuracy	Laboratory SPC limits for percent recoveries and RPD precision
Laboratory Control Standard (LCS)	One LCS per preparation batch	Laboratory SPC limits	Identify and correct the problem, then re-analyze all affected samples.	Laboratory Manager/Analyst	Accuracy/Bias	Laboratory SPC limits

MWIWP Worksheet #28 - Laboratory QC Sample Table

Matrix	Drill Cuttings / TCLP Leachate
Analytical Group	Metals
Sampling SOP	09, 10
Analytical Method/ SOP Reference	02, 03, 04, 05

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Dilution test	Each preparation batch	± 10% of true value	Perform post digestion spike (EPA 6010B) or matrix spike (EPA 7470A)	Laboratory Manager/Analyst	Accuracy/Bias	Perform post digestion spike (EPA 6010B) or matrix spike (EPA 7470A)
Post digestion spike addition	When dilution test fails	EPA 6010B Recovery within 75% to 125% of expected	Correct problem, then rerun samples by method of standard additions	Laboratory Manager/Analyst	Accuracy/Bias	EPA 6010B Recovery within 75% to 125% of expected
Instrument Detection Limit (IDL) Study	Once per 12-month period	EPA 6010B: IDLs will be below the MDL	Correct problem, then repeat the IDL study	Laboratory Manager/Analyst	Representativeness	
Method Detection Limit (MDL) study	Initial setup, once per 12-month period and quarterly MDL verification	Detection limits established will be below the RL	Correct problem, then repeat the MDL study	Laboratory Manager/Analyst	Representativeness	
Method blank	One per preparation batch	No analytes detected > 1/2 RL. For common lab contaminants, no analytes > RL	Correct problem, re-prep and reanalyze method blank and all associated samples if required	Laboratory Manager/Analyst	Representativeness	No analytes detected > 1/2 RL. For common lab contaminants, no analytes > RL
Laboratory control sample	One LCS per preparation batch	Laboratory SPC limits	Correct problem, then re-prep and reanalyze the LCS and all associated samples from the preparation batch for the analytes what failed, flag data if insufficient sample volume available for reanalysis	Laboratory Manager/Analyst	Accuracy/Bias	Laboratory SPC limits

MWIWP Worksheet #28 - Laboratory QC Sample Table

Matrix	Drill Cuttings / TCLP Leachate
Analytical Group	Metals
Sampling SOP	09, 10
Analytical Method/ SOP Reference	02, 03, 04, 05

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix spike	One MS per preparatory batch per matrix	Laboratory SPC limits	Identify the problem, if not matrix-specific re-prep and reanalyze MS and associated samples. Flag data if matrix interference indicated	Laboratory Manager/Analyst	Accuracy/Bias	Laboratory SPC limits
Laboratory Duplicates	One per preparatory batch per matrix	RPD < 50 %	Flag data if project specific precision not met	Laboratory Manager/Analyst	Precision	RPD < 50%
Surrogate Spike (organics)	All field and laboratory QC samples	Laboratory SPC limits	Correct problem then re-prep and reanalyze all failed samples if sufficient volume available	Laboratory Manager/Analyst	Accuracy/Bias	Laboratory SPC limits
MDL study	Initial setup, once per 12-month period and quarterly MDL verification	Detection limits established will be less than RLs	Correct problem,, then repeat the MDL study	Laboratory Manager/Analyst	Representativeness	Detection limits established will be less than RLs

MWIWP Worksheet #29 - Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Daily Activity Log forms or Logbooks Sample Collection Log forms or Logbooks Chain of Custody / Request for Analysis Records Shipper Waybills	FID calibration or calibration check documentation Water quality meter (pH, temperature, conductivity) calibration or calibration check documentation 4-gas meter calibration or calibration check documentation Ambient air FID methane measurement logs Water quality parameter measurement logs Explosive gases, %LEL, measurement logs	Laboratory sample receipt acknowledgement and log in Laboratory internal chain of custody and sample storage records Laboratory instrument calibration records Laboratory sample preparation logs Laboratory analysis run logs Laboratory analysis data and analytical report Sample disposal records	Completed sample Chain of Custody Records Laboratory analytical data package and electronic data deliverable Analytical data review and validation reports Audit / assessment checklists and reports Corrective action forms and reports	

MWIWP Worksheet #30 - Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Drill Cuttings - TCLP Leachate	Metals, VOC, SVOC	Low	Worksheet #18	Worksheet #23	21 day routine turnaround 5-day expidited turnaround may be requested	Test America Lori Parsons (303) 431-7171	Test America Debra Henderer (303) 431-717
Drill Cuttings	Gen Chem. Free Liquids	Low	Worksheet #18	Worksheet #23	21 day routine turnaround 5-day expidited turnaround may be requested	Test America Lori Parsons (303) 431-7171	Test America Debra Henderer (303) 431-7171

MWIWP Worksheet #31 - Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
National Environmental Laboratory Aliance Program lab assessment	Every 18 months. The laboratory must hold a current NELAP certification throughout the project duration	Ext.	NELAP	NELAP	Test America Laboratory QA Officer	Test America Laboratory QA Officer	Test America Laboratory QA Officer
Laboratory technical systems audit	If deemed necessary prior to start of sampling activities	Ext.	Shaw	Shaw Project Chemist	Test America Laboratory QA Officer	Test America Laboratory QA Officer	Test America Laboratory QA Officer and Shaw Project Chemist
Performance evaluation audit	If deemed necessary prior to start of sampling activities	Ext.	Shaw - submission of blind PE samples to laboratory	Shaw Project Chemist	Test America Laboratory QA Officer	Test America Laboratory QA Officer	Test America Laboratory QA Officer and Shaw Project Chemist
Field audits, initial and follow-up	At least once at beginning of sampling activities and then as needed during progress	Int.	Shaw	Shaw Project Quality Control Manager	Shaw On-Site Supervisor	Shaw On-Site Supervisor, Shaw Quality Specialist and Shaw Technical Directive Manager	Shaw Project Quality Control Manager

MWIWP Worksheet #31 - Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Field documentation review	At least once at beginning of sampling activities and then as needed during progress	Int.	Shaw	Shaw On-Site Supervisor, Shaw Project Quality Control Supervisor	Shaw On-site Supervisor	Shaw On-Site Supervisor, Shaw Project Quality Control Manager	Shaw Project Quality Control Manager

MWIWP Worksheet #32 - Assessments Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Sampling Technical Systems Audit	Findings report	Shaw Technical Directive Manager	Within 24 hours of field sampling audit	Corrective action response report	Shaw Quality Control Manager	5 days
Laboratory Technical Systems Audit (if performed)	Findings report	Laboratory QA Manager	5 days after audit	Correction action response report	Shaw On-Site Supervisor, Shaw Quality Control Manager, Shaw Waste Management Specialist, Shaw Technical Directive Manager, Shaw Project Manager	15 days

MWIWP Worksheet #33 - QA Management Report Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Quality Systems Audit Report	As needed or as determined Shaw QA management	TBD	Shaw QA Manager or designee	Shaw Technical Directive Manager, Shaw Project Manager

MWIWP Worksheet #34 - Verification (Step 1) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Work elements, personnel, subcontractors, plans, etc.	All elements of work, communications, quality control checks and reviews, etc. are specified in the work plan and associated planning documents. Internal and external approvals are to be verified.	Internal and External	Shaw Technical Directive Manager, QA Manager, US EPA Project Manager
Chain of Custody Records	Chain of Custody forms will be internally reviewed upon completion and verified against physical samples packaged for shipment and laboratory analysis.	Internal	Shaw On-Site Supervisor
Field notes, forms, notebooks	Field documentation will be internally reviewed and placed in the project file.	Internal	Shaw On-Site Supervisor and Technical Directive Manager
Laboratory data	Laboratory data will be reviewed for completeness and accuracy internally at the laboratory prior to final release to Shaw.	External	Laboratory project manager, laboratory QA manager
Audit reports	Any audit reports generated will become part of the project files. Findings responses and corrective actions implementations will be verified.	Internal	Shaw project manager and Technical Directive Manager

MWIWP Worksheet #35 - Verification (Step IIa and IIb) Process Table

Step IIa/IIb	*Validation Input*	Description	Responsible for Validation (Name, Organization)
IIa	All definitive data is collated: Field documentation, sample collection logs, Chain of Custody Records	Field sampling documentation will first be reviewed and verified in the field following creation. The review and verification will be for completeness and correctness of the information.	Shaw On-Site Supervisor
IIa	Documentation of analysis methods, QC measures, and report formats.	Shaw will review the analytical laboratory deliverables to ensure the correct analytical methods, batch QC samples, and reporting formats were followed. This review is for completeness and correctness.	Shaw On-Site Supervisor, Shaw chemist
IIb	Laboratory quality control sample results, reporting limits, etc.	Analytical data will be reviewed and compared to QAPP acceptance criteria to ensure data are of useable quality	Shaw chemist

MWIWP Worksheet #36 - Verification (Step IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	*Concentration Level*	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Drill Cuttings - TCLP Leachate	VOCs, SVOC, metals	Low	Completeness, agreement with EPA Methods and QAPP requirements	Shaw Chemist
IIa	Well development water	VOCs, SVOC, metals	Low	Completeness, agreement with EPA Methods and QAPP requirements	Shaw Chemist

MWIWP Worksheet #37 - Usability Assessment

Procedures used to assess overall measurement error associated with the project:
Data verification is defined as "confirmation by examination and provision of objective evidence that specified requirements have been fulfilled." Data validation is defined as "confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled" (EPA QAIG-5). The data usability evaluation will be conducted by a project chemist assigned by the Shaw Technical Direective Manager. Sample collection documentation will be reviewed for compliance with QAPP requirements to ensure representative samples are collected and analyzed.

The following guidelines will be considered during evaluation for usability:

- Review the case narratives pertaining to the data packages and establish that calibration assessmentswere performed.
- Review all qualifier flags based on acceptance criteria.
- Ascertain if the representativeness objective for the project was achieved.
- Identify data that do not meet project-specific sensitivity requirements.
- Evaluate if the data gaps prevent making decisions intended in DQOs.
- Document instances where professional judgment should be used and discuss them with the EPA chemist, if necessary.
- Document all evaluations, calculation, rejections, recommendations, and provide rationale for all specific validation actions.
- Submit a Quality Control Summary Report.

The project chemist or designee will review the entire definitive data report package with the field records, and apply the final data qualifiers for the definitive data. Shaw will evaluate laboratory data, QC results, and laboratory data qualifiers and apply data validation qualifiers. These qualifiers may be different than those applied by the laboratory. Definitions for Data Validation Qualifiers:

U Not detected above associated reporting limit
R Data not usable
J Estimated result, direction of bias undetermined
N Tentatively identified.

Shaw will use various checklists during the verification process to document all the verification activities. Completed checklists will be available for review upon request. However, these checklists should not be included as part of the data packages. All qualified data near the governing criteria will be evaluated against project DQOs as defined in Shaw, 2009, for fitness for use. Laboratory QC samples and measurements will indicate the extent of analytical error. Shaw will review the QC (laboratory and field) samples and field logs, and will then appropriately flag any of the associated samples identified with the QC samples. At minimum, case narratives, calibrations, blanks, spikes, and duplicates will be reviewed. Additionally, raw data such as chromatograms, mass spectra, and instrument output will be reviewed for transcription errors. Each MS sample will only be qualified by the laboratory. Shaw will apply the final qualifying flag for a matrix effect to the parent samples collected as the MS/MSD.

MWIWP Worksheet #37 - Usability Assessment

Data review and validation will be documented in data validation report. Data may be flagged with explanatory qualifiers and still useable for waste characterization. Final waste acceptance will be documented by disposal tickets or other on-site documentation presented in the final project report.

FIGURES

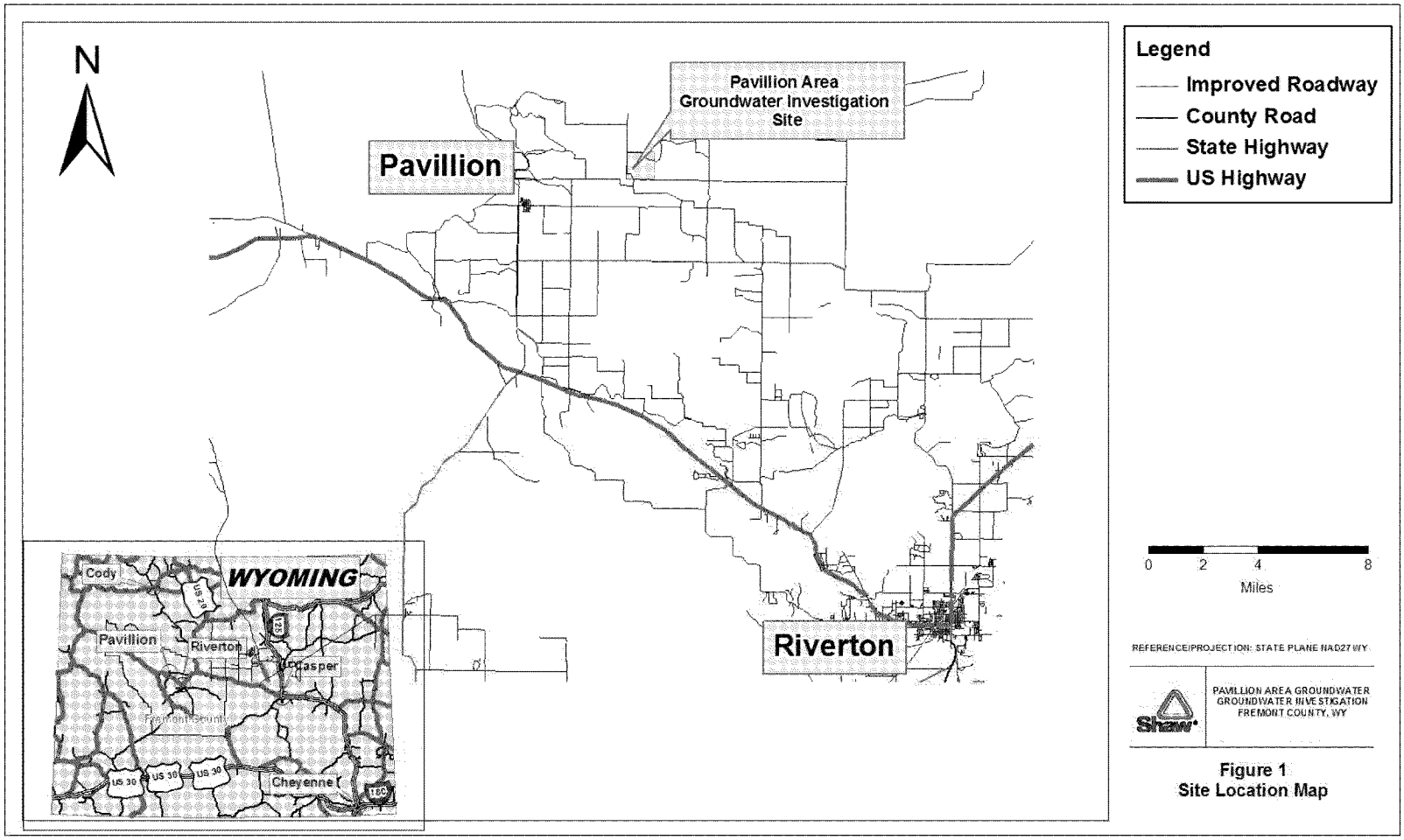


Figure 1
Site Location Map

Attachment 1
Monitoring Well Installation Work Plan Narrative

APPENDIX A
Site Safety and Health Plan

Appendix B
Waste Management Plan